Periscope.

a.—ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYSTEM.

FUNCTIONS OF THE BRAIN.—At the session of the Soc. de Biologie, June 28 (*Le Progrès Médical*, July 6), M. Tarchanoff presented a communication in regard to the development of the psycho-motor centres in various animals From researches on rabbits and dogs Soltmann has been led to the conclusion that these centres do not make their appearance until the tenth day, when the senses are developed ; the action of external agents is therefore indispensable for the formation of these psycho-motor centres. Besides, in both an anatomical and a chemical point of view, the brain presents decided differences, according as we examine it in the new-born or the adult animal. In such animals as from birth are in full exercise of their senses, and perfect in locomotion (Guinea pigs and hedgehogs), M. Tarchanoff found the brain much more developed, and the cranium more resistant ; the moderating power over the reflex possessed by these psycho-motor centres appeared shortly after birth, while it was lacking in the rabbit. Further, in the Guinea pig the excitation of the pneumogastric arrested the movements of the heart, while it was ineffectual in the case of the rabbit.

Anatomically, the differences are also striking; thus, in the first, the circulation of the grey layers is more developed ; and there are found there giant and pyramidal cells. The brain of the rabbit, less vascular, contains but few giant and no pyramidal cells ; and, moreover, the nerve fibres are destitute generally of myeline. M. Tarchanoff explains these differences, less by the duration of gestation than by the intensity of nutrition, during intra-uterine existence. He found that by the administration of phosphorus to new-born animals, he could accelerate the development of the functions of the psycho-motor centres. The same result followed putting the animal head downward and thus producing a cerebral hyperæmia.

INTERNAL CAPSULE.—In following the development of the medullary sheaths, P. Flechsig has succeeded in separating the systems composing the internal capsule. (*Bericht d. Muenchener Naturforsch. Vers.* 1877, p. 226.) In the especially adapted human fœtus, at full term, there exist three systems of medullated fibres, and several of unmedullated fibres. Of the former, one passes along the outer edge of the thalamus opticus (corona radiata of the same going to the parietal lobe) ; a second system is found along the internal edge of the nucleus lenticularis, so as to form the chord of the arch of the internal lamina medullaris. The fibres of this system come from the laminæ medullares of the lenticular body, pass along its internal section transversely through the internal capsule, and continue their course partly

above, partly underneath, and partly through the body of Luys into the tegmentum pedunculi. (Regio subthalamica. Forel.)

The ansa lenticularis passes with this bundle. A third system of medullated fibres, generally elliptical on cross section, is found in the posterior third of the internal capsule, occupying its full breadth. Downwards it is continuous with the third (external) quarter of the pes pedunculi, and finally the pyramids, while upwards it passes into the central convolutions. The systems of fibres not medullated, in the internal capsule of the fœtus, consist of a larger portion in front, and a smaller part behind the pyramidal tract. The former continue along the internal half, the latter along the external fourth of the pes pedunculi. Both sets can be traced downwards no further than the pons.

THE SEMICIRCULAR CANALS.—The following are the conclusions of M. Cyon, from his own investigations, as announced to the Acad. des Sciences, Paris, Dec. 31, *Centralbl. f. d. med. Wissensch.*, No. 27, 1878.

1. They are the peripheral organs of the sense of space; the sensations produced by the irritations of the terminations of the nerves in the ampullæ of these canals, are destined to help us to form the idea of the three dimensions of space; the sensation experienced in each one of these corresponding to one of these three dimensions.

We form with their assistance an ideal space in which the perceptions of all the other senses are referred, in so far as concerns their relations to the surroundings, and the position of our own bodies. The empiristic theory of Helmholtz, in regard to binocular vision, and the nativistic theory of Hering, are by the presence of a special sense of space brought as it were upon a neutral basis.

The physiological excitation of the peripheral terminations of the special space-sense, is probably effected by the otoliths of the ampullæ; they can be put into vibration by active or passive motion of the head, or by currents of air.

The eighth pair of cranial nerves includes two altogether separate nerves: the auditory nerve and the nerve of the sense of space. The central organ of the space-sense determines the distribution and the degree of the innervation force for all the movements of the eyes, the head and the rest of the body. The disturbances from injury to the semicircular canals are to be referred (1,) to a visual vertigo, due to the difference between the ideal and the actually seen space; (2,) to the resulting false conceptions of our bodily position in space; and (3), to the disturbances in the distribution of innervation to the muscles.

Further details are promised on the subject.

THE MOTOR AND SENSORY CELLS.—At the session of the Acad. des Sciences, Paris, June 4 (reported in *L'Union Médicale*), M. Vulpian presented a communication from M. Pierret, Professor of the Faculty at Lyons, on the constant relations existing between the volumes of the motor and sensory cells of the nervous centres, and the length of tract over which incitations emanating from or returning to them have to traverse.

After the discoveries of Ch. Bell and Magendie, on the role of the anterior and posterior roots, and since we have come to recognize the ganglionary elements of the substance, it has been admitted by the majority of physiologists, that both motor and sensory cells exist in the nerve centres.

This division is sanctioned by the works of modern anatomo-pathologists.

We know, therefore, beyond question, that there exist in the myelencephalon motor and sensory ganglia, whence arise, or in which terminate, all the sensory and motor fibres. It seems logical to determine with care the morphological characters of the cells of these various ganglia, and thus to obtain information as to the true function of certain ganglionary groups, the anatomical relations of which are still undetermined.

This investigation, performed in an incomplete manner, and under the influence of preconceived ideas, has hitherto given only erroneous results. By comparative examinations, involving all the motor and sensory nuclei, I have obtained the following results:

These studies were made on the motor and on the sensory nervous systems.

A. *Motor Nervous System.*—(1.) The largest nerve cells are found in the lumbar region of the spinal cord, and in the fronto-parietal convolutions of the brain (paracentral lobe. Betz). These two points are in relation with each other, and the distance between them is considerable. Moreover, the largest nerves of the human body (sciatics) arise precisely from that point of the lumbar cord where we find the largest, so-called motor, cells.

In the dorsal region the anterior cells are one-half smaller than those of the preceding. The distance separating them from the brain diminishes and the nerves arising here are proportionately short.

(2.) In the cervical region the motor cells are larger than in the dorsal region, but smaller than those in the lumbar, this being related on the one hand to the length of the brachial nerves, and on the other to the lesser distance that separates them from the cerebral centres.

The same is the case with the nucleus of the hypoglossus, the cells of which are a little smaller than those of the anterior cornua of the cervical cord.

For analogous reasons the nerve cells of the superior motor ganglia diminish gradually in volume, as they are nearer to the brain, and as their connected peripheral nerves are shorter.

Thus, the external motor oculi nucleus contains larger cells than does that of the patheticus, or that of the motor oculi communis. The cells of the two latter are equal in size, but are very small, and have lost all those characters of elegance usually attributed to motor cells.

Finally, in the corpus striatum the cells are still smaller, and cannot be distinguished, as to form, from those of the thalamus, which are more voluminous, or of the geniculate bodies, or tubercula quadrigemina.

We may, therefore, say that the form and volume of the nerve cells cannot furnish any very reliable index of their function.

In fact, the form of the sensory cells in man is the same in all the ganglions composed of the brain. On the other hand, the volume of certain motor cells (patheticus nucleus) is less than that of neighboring sensory cells (optic thalamus, nucleus of the trigeminus).

B. *Sensory Nervous System.*—(1.) The largest cells are met with in the columns of Clarke, in the neighborhood of the lumbar region. These columns, indeed, receive the centripetal fibres from the lower limbs, and are as far removed from the brain as is possible.

(2.) The cells of the restiform ganglia and of the trigeminus nucleus are smaller than those of the columns of Clarke. The former receive the sensory fibres from the brachial nerves; the trigeminus nucleus receives the fibres of that nerve; and both the two ganglionic masses are comparatively nearer to the cerebral cortex than the columns of Clarke.

(3.) The cells of origin of the optic nerve are smaller than those of the trigeminus, and larger than those of the olfactory.

(4.) The shortest sensory nerve and also the one most contiguous to the occipital lobe (auditory nerve) is also the one which in man has in its nucleus the smallest cells.

The law of increase or decrease of the ganglionary elements is therefore the same for the sensory as for the motor nerves. It may be stated as follows:

The dimensions of the motor or sensory nerves are *in man* in direct proportion to the distance which intervenes between the peripheral organ they innervate and the cerebral centres; or stated in a more general way:

The dimensions of the nerve cells are in direct proportion to the distances over which their motor or sensory impulses must travel.

This formula comprehends two terms, equal in value:

1. The length of the nerves in relation with the cells.
2. The distance between the cell of first reflection and its analogue in the convolutions.

This law holds good for the cortical cells, since we find the largest ones in the parieto frontal regions which are in relation with the inferior members; and we also meet with cells as large in certain portions of the occipital convolutions.

Termination of Nerves in the Unstriped Muscles.—M. Ranvier in a recent note to the Acad. des Sciences, May 27 (reported in *L'Union Médicale*) announces the following conclusions as to the terminations of the nerves in the unstriped muscular fibre: (1) The nerves terminate in the smooth as in the striped muscles, in a more or less arborescent expansion of the cylinder axis. (2) The nerve net-work for the involuntary unstriped muscles (muscles of organic life) is in relation, not with the elementary nerve action which calls the muscle into activity, but rather with a more complex action on which depends the functional synergy of an organ whose activity is dependent on the direct action of the nerve centres. In support of this, he calls attention to the fact that the muscular tunic of the œsophagus of mammals, formed in great part of striated fibres, but which does not contract under the direct influence of the animal's volition, possesses a plexiform apparatus, and that the same has been observed in the striated muscles of the digestive tube of the arthropods.

There is scarcely need now to study why the different authors who have studied the terminations of the nerves in the unstriped muscles, have dis-

cussed whether they terminate in free ends or in anastomoses. These anastomoses exist, but in reality they form simple plexuses from which arise the terminal fibres.

THE DILATOR NERVES OF THE PUPIL.—At the session of the Acad. des Sciences, June 10 (reported in *La France Médicale*), M. Vulpian presented the following communication:

I showed, some years since (*Arch. de Physiol.*, 1874, p. 177), that the ablation of the superior cervical ganglion in dogs, did not prevent the reflex movements of pupillary dilatation from being produced on the corresponding side. Did this experimental result show that the sympathetic fibres destined for the iris came from the lower cervical ganglion or from the superior thoracic ganglion reaching their destination, passing with the vertebral artery through the canal in the transverse processes of the cervical vertebræ? Is it necessary to seek the explanation in another hypothesis, according to which the nerve fibres of the pupil dilating the pupil when put in action, arise directly from the brain with certain cranial nerves, the trigeminus and motor oculi? Such were the questions that I was striving to answer when the following facts came to light.

My recent researches, undertaken to test the interesting investigations of MM. Luchsinger and Kendall, Ostrumoff and Nawrocki, relative to the influence of the nervous system on the sudoriparous glands, led me to discover that, in the cat, under the influence of the electrical excitation of the cutaneous surface of the body, or of the upper portion of the divided sciatic, the pupil still dilates on the side from which the superior thoracic and all the lower portion of the cervical sympathetic has been removed. The dilatation, though much less than that of the opposite side, is very clearly perceived, and occurs whenever the above described excitation is repeated.

After having definitely observed this fact, I sought to find whether the same phenomenon would take place in a cat in which not only the superior thoracic ganglion, but also the superior cervical ganglion had been removed. This experiment was performed by cutting the thoracic sympathetic below the upper thoracic ganglion (which as regards the iris is equivalent to its extirpation) and excising completely the superior cervical ganglion. But under these conditions, we have observed that faradic excitations of the skin or of the superior portion of the divided sciatics caused a pupillary dilatation, each time of the same side, incontestable though feeble.

This experimental result refutes one of the two hypotheses which it seemed to me were required to explain the pupillary dilatation under painful excitations after the removal of the superior cervical ganglion. It appears to authorize the admission that nerve fibres acting as dilators of the pupil, come directly from the brain, mixed probably with fibres from such of the cranial nerves as have connections with the ophthalmic ganglion.

MUSCLE-TETANUS.—H. Kronecker and W. Stirling (*Arch. f. Anat. und Phys.*, 1878, p. 1). Ranvier has lately pointed out the anatomical and physiological differences between the pale and red muscles of one and the same animal, for instance, the vastus int. (white) and the semi-tendinosus (red)

muscles of the rabbit. On registering the change of shape of the muscle during contraction by means of a "pince myographique" of Marey, R. found that a current of 56 interruptions per second produced an almost uniform tetanus of the red muscle, while the white still registered successive contractions. A current of even 357 interruptions did not suffice to put the white muscle into a state of complete uniform tetanus, although the tracing of the red muscle on the rotating cylinder was a straight line without oscillations.

According to Helmholtz, the single contraction of a frog's muscle is completed in one-fifth second, while Marey determined the time of contraction of a rabbit's muscles as one-thirteenth second. If a second contraction is induced before the maximum of the first is passed, the two superimpose, and hence a tetanic contraction requires a stimulating current whose interruptions are more numerous than the greatest number of isolated contractions which the muscle can execute per second. Human muscles are tetanized by less than 32 interruptions per second. A muscle when tetanically contracted will emit a sound, the vibrations of which equal in number the interruptions of the current irritating the muscle. If, on the other hand, a muscle is tetanized by irritation of the spinal cord, the muscle-sound corresponds always to about 20 vibrations per second. This proves that a complete muscular tetanus can be maintained by 20 impulses per second. Between this number and Ranvier's results there is a remarkable difference.

Kronecker and Stirling determined, in the first place, that 20-30 interruptions per second suffice to put the white muscle (gastrocnemius medialis) into a state of uniform tetanus, while ten shocks per second can tetanize the red muscles (soleus) of the rabbit. The elongation and contraction of the muscles was directly registered by the myographion. Ranvier, on the other hand, had measured the thickening of the contracted muscle by means of a "pince myographique," which consists of a receiving and a registering air chamber, closed by elastic membranes. Such an apparatus will readily register vibrations, and the appearance of oscillatory contractions of muscle was undoubtedly due to mere vibrations of their mass. With Ranvier, Helmholtz and Stirling found that the single contraction of the red muscle was slower and more protracted than that of the white. Furthermore, they determined the greatest number of interruptions still able to tetanize a muscle. The interruptions were produced by means of a new induction apparatus. The limit could not be found, since 22,000 interruptions per second still produced a uniform tetanus. A muscle will thus correspond to a stimulus of less than 0.00005 second duration.

Influence of the Accelerator Nerve on the Systolic Duration.—N. Baxt (*Arch. fuer Anat. und Phys.*, 1878, p. 122) has registered directly the movements of the heart, exposed in the curarized animal, by placing a light vertical rod of wood on the anterior side of the heart. The rod slid up and down in a glass tube ; to its end was attached a glass pen writing on the revolving cylinder. It was thus found that normally the systole does not vary much in duration, lasting 0.25 to 0.28 second. The frequency of the beat depends hence mostly on the duration of the individual diastoles. During

irritation of the accelerator nerve, however, both systole and diastole are shortened, although the latter more than the former.

Movements of the Iris.—Raehlmann and Witkowski (*Arch. f. Anat. und Phys.*, 1878, p. 110), have made observations on the size of the pupil during sleep. In agreement with older observations, they found the pupil contracted during sleep, the actual size, it seems, diminishing with the intensity of sleep. Nevertheless, the pupils react slightly to light. All sensory impressions dilate the pupil, as mere touch or tickling; especially is this noticeable at the moment of awaking. During sleep the size of the pupil does not vary with the ocular movements. Movements of convergence have no effect on the iris, although during waking they are always accompanied by pupillary contraction. Similarly, the authors found that the occasional movements of convergence, which can be observed in new-born children, are not accompanied by pupillary changes.

The cause of the myosis during sleep and narcosis Raehlmann and Witkowski explain in part by the absence of any dilating tendency due to sensory impressions. They admit, however, that a role must also be attributed to the ganglionic cells of the iris.

A New Origin of the Optic Nerve.—J. Stilling, *Centralblatt f. d. med. Wissensch.*, No. 22, states that the opinion hitherto held that the fibres of the optic tract have no connection with the crus cerebri, is incorrect; on the other hand, he finds that a rather considerable part of these fibres arise from a large nucleus situated in the lower crus, which is laid open only when there is nothing to be seen of the substantia nigra in the section. In horizontal and vertical sections it appears shaped like an almond, hence it may perhaps be designated as the *nucleus amygdaliformis*. The optic fibres joining it must, to reach it, take a recurrent course from their former direction. The whole situation of this nucleus, its size, etc., indicate that we must look at it as an intermediate ganglion for reflex excitations.

The Optic Decussation.—The following is the substance of a note by M. Nicati, presented to the French Academie des Sciences, June 10, by M. Vulpian, and reported in *La France Médicale*, June 26:

Biesiadecki, Mandelstamm and Michel have, in Germany, successively attacked the opinion current since the publications of Newton, Wollaston, and Hannover, of an incomplete crossing of the fibres of the optic nerve in the chiasm. The numerous memoirs that have since appeared have not settled the question, for quite recently Michel has sustained, in a long article in reply to Gudden, the existence of a complete decussation in all the mammals examined and in man.

1. The following experiment ought to destroy all doubts; it proves that the decussation is incomplete in the cat. When we divide the chiasm in the median line, and the animal still sees, the demonstration is made.

But this experiment has been performed by MM. Eugene Dupuy and Brown-Séquard, and by M. Beauregard; the latter operating on birds. M. Brown-Séquard does not state what animals were the subjects of his experi.

ments, but from his memoir it seems probable that they were only rabbits and Guinea pigs. The result in the two cases was complete blindness.

The result I have obtained was very different. I operated on cats. These animals do not lose their vision at all from a longitudinal section through the middle of the chiasm. After the operation they move with assurance and give the most varied proofs of the existence of sight. It is needful to choose young cats for this operation, at the age when they begin to move about freely and with vivacity. These animals endure the operation well, and the liveliness of their movements permits the determination of the fact that they see.

The section is made through the mouth, penetrating the cranium through the bones at its base. I use for this a peculiarly shaped bistoury, the curve of which suggests a turnkey for drawing teeth. (It is composed of a single tempered steel strip, the extremity of which is filed so as to form a straight cutting edge of $0^{M}.012$, carried at a right angle on a long portion of $0^{M}.010$, a length corresponding to the entire thickness between the palate and the dura mater; the remainder of the steel strip is in the shape of a handle curved laterally and at a right angle to the preceding portion. This handle itself is again bent in such a way as to avoid the dental arch.)

By the aid of this bistoury we perforate the base of the cranium between the bony palate and the velum palati, then bringing the instrument more forward we bend the blade backward and downward on the chiasm, which we divide by pressing it strongly against the bone.

2. Desiring to prove that the result reached with the cat is applicable also to man, I sought to establish the structural identity of their chiasms. The chiasms of the cat, man, and the dog, are clearly distinguished from those of the rabbit and Guinea pig by being much larger. I have measured their areas in section, and find constant relations between them, which are the same for the cat and man, but absolutely different from those we find in the rabbit.

Thus, in man and in the cat, the squared surface of a longitudinal section in the median line, compared with that of a transverse section through the middle of the organ, is in the proportion of one to three. The transverse section, in other words, gives a surface three times greater than that of a perpendicular section.

In the rabbit on the other hand, where the decussation appears to be complete, these sections are equal in surface.

To the development in size of the chiasm in man and in the cat corresponds the fact that the nerves and optic tracts join each other in the chiasm at a very obtuse angle, contrary to the manner in the rabbit and Guinea pig.

Asymmetry of the Cranium.—Dr. Gustave Le Bon, in a communication to the Soc. de Méd. Pratiques, *La France Médicale*, No. 28, 1878, gives the results of a series of measurements of crania, to ascertain what was the constant condition as to symmetry, and on which portion was the predominance of development. These measurements do not altogether support the theory, that the left side of the skull, and correspondingly, of the brain upon which it is modeled, exceeds the right side in its dimensions, which had gained

some credence on account of the general superior development of the right half of the body, which is functionally related to the left cerebral hemisphere. He found in the measurements of two hundred and eighty-seven crania, the following :

Crania in which the right predominated over the left side, 125 ; crania in which the left side predominated over the right side, 111 ; crania presenting various irregularities, but not such as to create any decided unilateral predominance, 51.

From this it appears that there is no general rule as to the asymmetry of the skull ; that the predominance is even more likely to appear on the right than on the left side, where *a priori*, it might be looked for.

Dr. Le Bon was led by his measurements to at first think that the skull was most developed in intelligent persons on the left side, but the imperfection of his instrument with which he measured his living cases, led him to distrust this conclusion, at least as a certainty.

Though the skull may be said to be modeled on the brain, there yet appears to be an opportunity for error in using only its external measurements. Dr. Le Bon does not state, but the presumption is that these were all that he took. His crania were taken from different series in the Museum of Anthropology, and may, also, not fairly represent the average development in civilized man, and internal casts, under the circumstances, could hardly have been allowed.

NUCLEUS OF THE FACIAL AND ABDUCENS NERVES.—Dr. W. R. Gowers, *Centralblatt*, No. 23, 1878. The grey nucleus in the floor of the fourth ventricle underneath the eminentia teres, has heretofore been considered the common nucleus of the facial and abducens nerves. All fibres of the abducens nerve pass from it at its internal side, while from its external side there issue all those fibres of the facial nerve which do not pass over it in the "genu facialis."

It is taught that the facialis fibres originate in the cells of this nucleus. Gowers, however, had the chance to observe the real relationship in a medulla with complete degeneration of both abducens nerves. No fibres of the last-named nerves were found ; the paralysis of the external recti muscles had been complete and of long duration. The facial nerves were intact. But the grey nucleus was completely atrophied, almost all nerve cells had disappeared. The few cells still existing were of less than normal size, and had lost their processes. The degeneration was uniform in degree throughout the entire nucleus. But through the atrophied nucleus there passed many normal nerve fibres, single and in bundles, upwards and outwards. These were the fibres of the facial nerve supposed to originate in this nucleus. It is therefore certain, that the grey substance of the nucleus belongs to the abducens nerve, and that the facialis fibres pass through it simply, but originate probably at the same place as the other fibres passing along the genu facialis.

NEGATIVE OSCILLATION OF MUSCLE-CURRENT.—The negative oscillation which the electric current of the muscle presents during every muscular contraction, has been interpreted by its discoverer, DuBois-Reymond, as the

electric manifestation of the physiological process of contraction. M. d'Arsonval, however (*Gaz. des Hopitaux*, No. 59, 1878), contends that this phenomenon is purely physical in its origin, in proof of which he refers to the remarkable experiments of Lipman on the currents derived from the contact of non-miscible conducting fluids. The fundamental experiment of that physicist is the following: Two test-tubes are partly filled with mercury, and above the mercury with acidulated water. Contact between the water in the two glasses is established by means of a bridge of wet cotton, while wires touching only the mercury pass to a galvanometer. As long as the two test-tubes are held vertically no current exists, while the needle of the galvanometer is deflected as soon as one of the tubes is slightly inclined. The enlargement of the surface of contact between the two liquids, produced by inclining one tube, results in a positive oscillation, while a negative oscillation is always produced by diminishing the extent of the surface of contact. This current is not due to chemical action; it is simply a transformation of movement into electricity.

When a muscle contracts, it tends to assume a spherical shape. Since a sphere possesses less surface than the same quantity of matter in any other shape, a negative oscillation must result. On the other hand, when a muscle is stretched, its extent of surface is increased, hence a positive oscillation. If two muscles are so arranged that the contraction of one produces an elongation of the other, the currents derivable from each correspond to the requirements of the theory, while if the two poles are inserted into corresponding spots of both muscles at the same time, the opposite oscillations will neutralize each other.

These negative and positive oscillations can be derived not only from the living, but also from the dead muscle, by changing their shape mechanically. It can also be observed in rubber and similar substances.

The negative oscillation is observed also in muscles the actual contraction of which is prevented by mechanical restraint. Although under such circumstances the muscle does not change its shape as a whole, still, as Ranvier has observed under the microscope, there is a similar approach to spherical shape of the ultimate contractile elements (thick disks), and hence a diminution of their extent of contact with the intra-muscular fluid. Physiologically, therefore, the negative oscillation of the muscle-current indicates simply a variation in the surface of contact.

SINEW REFLEX.—In order to determine whether the muscular contraction due to percussion of a tendon is reflex in its nature, or a direct muscular stimulation, G. Burkhardt ("Ueber Sehnenreflexe," Festschrift dem Andenken an A. von Haller dargebracht, Bern, 1877) undertook to measure the time required by the phenomenon. Between the concussion of the tendo patellaris *in man* and the contraction of the upper part of muscle quadriceps femoris, there elapsed a period of 40 thousandths of a second, while the contraction of the lower part of the muscle commenced within 38.7 thousandths second. This time is too short to permit a comparison with cutaneous reflexes, which latter consume double that time in passing only through the grey substance of the cord. Similar results were obtained

from rabbits. In that case the time consumed was 17.1 thousandth second, *i. e.*, one-half to one-fifth of the time requisite to obtain a reflex action from cutaneous stimulation. If on the other hand the contraction were due to direct stimulation of the muscle, there ought to be a perceptible difference in the time of contraction of the upper and lower end of the muscle. The velocity of the muscle wave being stated as one to three metres per second, a period of twenty to thirty thousandths second might be expected to elapse while the wave of contraction travelled through the entire muscle of about twenty centimetres length. In reality only one-tenth of that time elapses between the contraction of the upper and lower end of the muscle. Furthermore, B. found that (1) sinew-reflexes continue *without* change of duration after section of the spinal roots, or destruction of the lumbar cord, after which of course all cutaneous reflexes have ceased. (2.) Both cutaneous and sinew-reflexes continue partly after section of the cord at the level of the first lumbar vertebra. The time of the former, however, but not of the latter, is prolonged by this operation. (3.) Section of the crural nerve prevents cutaneous and sinew-reflexes. (4.) Small doses of strychnia intensify sinew-reflexes, but do not change their time. (5.) Crossed sinew-reflexes (from one side to the other) require as much time as cutaneous reflexes.

From these data B. concludes that the sinew-reflex is really reflex in its nature, but that it cannot pass through the cord, possibly, however, through the plexus or spinal ganglia. The tendon is hence connected through a nervous route with the muscle, but this route goes neither directly to the muscle, nor does it pass through the spinal cord. The reflex contraction started by stretching of the tendon, as from over action of the antagonistic muscles, is a process of too rapid onset to be influenced by the will. *Centralblatt f. d. med. Wiss.*, No. 22, 1878.

We add the titles of some additional articles on the Anatomy and Physiology of the Nervous System and Mind:

Bufalini, The Structure of the Spinal Cord in the Fœtus, *Lo Sperimentale*, September; Baumgarten, On the so-called Decussation of the Optic Fibres, *Centralbl. f. d. med. Wissensch.*, No. 31; Gowers, Incomplete Crossing of the Optic Fibres, *Ibid;* Maragliana, Motor Localizations in the Cerebral Cortex, studied specially from the clinical side, *Rivista Sperimentale*, IV., 1; Tartuferi, On the Microscopic Anatomy and the Cellular Morphology of the Bigeminal Eminence in Man and other Animals, *Ibid;* Luciani and Tamburini, Experimental Researches on the Functions of the Brain, *Ibid;* Mayer, Results of Researches on the Stoppage and Restoration of Blood Currents in the Head, *Centralblatt f. d. med. Wissensch.*, No. 33.